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(81) Designated States (*unless otherwise indicated, for every
kind of national protection available*): AE, AG, AL, AM,
AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,

CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,
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MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG,
PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM,
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM,
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pean (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR,
GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK,
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
ML, MR, NE, SN, TD, TG).

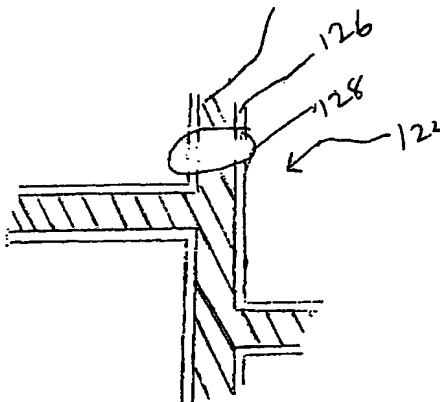
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27 January 2005

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(54) Title: FUEL CELL, COMPONENTS AND SYSTEMS



(57) Abstract: Alkali fuel cells, systems, and related methods, and flow-through, high-surface area electrodes, are employed to generate electricity. The electrode can include a porous substrate comprising a first side for fluid egress, a second side for fluid egress, and a plurality of walls (122) oriented in different directions between the first and second sides. Voids can be defined between the walls. The walls can include surfaces and micro-scale pores (128). A multi-directional fluid flow path can be defined between the first and second sides. A thin film comprising a catalytic material can be disposed on the surfaces. A fuel/electrolyte mixture can be flowable generally from the first side, through the voids and the pores of the substrate and in contact with the thin film (126), and to the second side. Additives can be included for refreshing the electrolyte and/or the electrode. A water/thermal/pressure management system includes a permeable membrane from which water can be removed from a fluid while retaining fuel and/or electrolyte in the fluid. The electrolyte can include an additive that cleans the electrodes. A refresh cycle can be implemented in which one or more electrodes are operated in a mode that refreshes catalytic material of the electrode.

WO 2004/095605 A3



For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/12635

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : H01M 4/86, 8/02, 8/04

US CL : 429/13, 38, 40, 44

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 429/13, 15, 38, 40, 41, 42, 43, 44, 45

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Please See Continuation Sheet

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6,365,291 B1 (MARGIOTT) 02 April 2002 (02.04.2002), column 9, lines 6-12, figure 1.	58
X	US 6,329,089 B1 (ROBERTS et al) 11 December 2001 (11.12.2001), column 3, lines 5-16, column 3, line 64-column 4, line 26.	65, 66
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X	US 4,529,670 A (FINDL) 16 July 1985 (16.07.1985), column 4, lines 26-62, column 5, lines 47-49, figure 1.	59
X	US 4,522,895 A (SHIGETA et al) 11 June 1985 (11.06.1985), column 2, lines 41-46, column 3, lines 35-56.	27, 28
A	US 5,364,711 A (YAMADA et al) 15 November 1994 (15.11.1994), column 10, lines 16-43.	44-49



Further documents are listed in the continuation of Box C.



See patent family annex.

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later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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document member of the same patent family

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Name and mailing address of the ISA/US

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Commissioner for Patents
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Authorized officer

Stephen J. Kalafut

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/12635

Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claim Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claim Nos.: 7-24
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
There are no claims with these numbers present in the application.
3. ☐ Claim Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐
☐

The additional search fees were accompanied by the applicant's protest.

No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

PCT/US04/12635

Continuation of B. FIELDS SEARCHED Item 3:

EAST: USPATS, USPGPUBS

search terms: pore, porous, porosity, dense, density, plural, multiple

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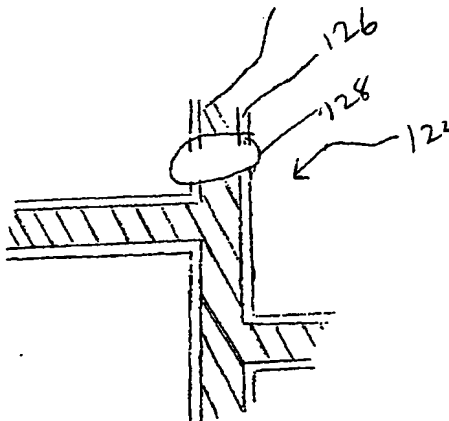
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Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230	Authorized officer Stephen J. Kalafut Telephone No. 571-272-1700

INTERNATIONAL SEARCH REPORT

PCT/US04/12635

Continuation of B. FIELDS SEARCHED Item 3:

EAST: USPATS, USPGPUBS

search terms: pore, porous, porosity, dense, density, plural, multiple